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EXAMINER	
WONG, EDNA	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/688,420	KLOCKE ET AL.	
	Examiner	Art Unit	
	EDNA WONG	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *05 May 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-7,14,15,19-22,26,55-62,66 and 68* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-7,14,15,19-22,26,55-62,66 and 68* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *May 5, 2008*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on May 5, 2008 has been entered.

This is in response to the Amendment dated May 5, 2008. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office Action.

Response to Arguments

Claim Rejections - 35 USC § 103

Composition

I. Claims **1-5** have been rejected under 35 U.S.C. 103(a) as being unpatentable over **Reid et al.** (US Patent No. 6,793,796 B2) ['796] in combination with **Reid** (US Patent No. 6,024,857) ['857].

The rejection of claims 1-5 under 35 U.S.C. 103(a) as being unpatentable over Reid et al. ['796] in combination with Reid has been withdrawn in view of Applicants' amendment.

II. Claims **6-14** have been rejected under 35 U.S.C. 103(a) as being unpatentable over **Reid et al.** (US Patent No. 6,793,796 B2) ['796] in combination with **Reid** (US Patent No. 6,024,857) ['857].

The rejection of claims 6-14 under 35 U.S.C. 103(a) as being unpatentable over Reid et al. (US Patent No. 6,793,796 B2) ['796] in combination with Reid has been withdrawn in view of Applicants' amendment. Claims 8-13 have been cancelled.

III. Claims **15-18** have been rejected under 35 U.S.C. 103(a) as being unpatentable over **Reid et al.** (US Patent No. 6,793,796 B2) ['796] in combination with **Reid** (US Patent No. 6,024,857) ['857].

The rejection of claims 15-18 under 35 U.S.C. 103(a) as being unpatentable over Reid et al. ['796] in combination with Reid has been withdrawn in view of Applicants' amendment. Claims 16-18 have been cancelled.

IV. Claims **19-25** have been rejected under 35 U.S.C. 103(a) as being unpatentable over **Reid et al.** (US Patent No. 6,793,796 B2) ['796] in combination with **Reid** (US Patent No. 6,024,857) ['857].

The rejection of claims 19-25 under 35 U.S.C. 103(a) as being unpatentable over Reid et al. ['796] in combination with Reid has been withdrawn in view of Applicants' amendment. Claims 23-25 have been cancelled.

V. Claims **26-33** have been rejected under 35 U.S.C. 103(a) as being unpatentable over **Reid et al.** (US Patent No. 6,793,796 B2) ['796] in combination with **Reid** (US Patent No. 6,024,857) ['857].

The rejection of claims 26-33 under 35 U.S.C. 103(a) as being unpatentable over Reid et al. ['796] in combination with Reid has been withdrawn in view of Applicants' amendment. Claims 27-33 have been cancelled.

VI. Claim **34** has been rejected under 35 U.S.C. 103(a) as being unpatentable over **Reid et al.** (US Patent No. 6,793,796 B2) ['796].

The rejection of claim 34 under 35 U.S.C. 103(a) as being unpatentable over Reid et al. ['796] has been withdrawn in view of Applicants' amendment. Claim 34 has been cancelled.

VII. Claims **35-43** have been rejected under 35 U.S.C. 103(a) as being unpatentable over **Reid et al.** (US Patent No. 6,793,796 B2) ['796] in combination with **Reid** (US Patent No. 6,024,857) ['857].

The rejection of claims 35-34 under 35 U.S.C. 103(a) as being unpatentable over Reid et al. ['796] in combination with Reid has been withdrawn in view of Applicants' amendment. Claims 35-43 have been cancelled.

VIII. Claims **44-52** have been rejected under 35 U.S.C. 103(a) as being unpatentable

over **Reid et al.** (US Patent No. 6,793,796 B2) ['796] in combination with **Reid** (US Patent No. 6,024,857) ['857].

The rejection of claims 44-52 under 35 U.S.C. 103(a) as being unpatentable over Reid et al. ['796] in combination with Reid has been withdrawn in view of Applicants' amendment. Claims 44-52 have been cancelled.

IX. Claims **53 and 54** have been rejected under 35 U.S.C. 103(a) as being unpatentable over **Reid et al.** (US Patent No. 6,793,796 B2) ['796] in combination with **Reid** (US Patent No. 6,024,857) ['857].

The rejection of claims 53 and 54 under 35 U.S.C. 103(a) as being unpatentable over Reid et al. ['796] in combination with Reid has been withdrawn in view of Applicants' amendment. Claims 53-54 have been cancelled.

Method

X. Claims **55-56, 58, 60 and 62** have been rejected under 35 U.S.C. 103(a) as being unpatentable over **Reid et al.** (US Patent No. 6,793,796 B2) ['796] in combination with **Uzoh et al.** (US Patent Application Publication No. 2002/0033342 A1).

The rejection of claims 55-56, 58, 60 and 62 under 35 U.S.C. 103(a) as being unpatentable over Reid et al. ['796] in combination with Uzoh et al. has been withdrawn in view of Applicants' amendment.

XI. Claims **57, 59 and 61** have been rejected under 35 U.S.C. 103(a) as being unpatentable over **Reid et al.** (US Patent No. 6,793,796 B2) ['796] in combination with **Uzoh et al.** (US Patent Application Publication No. 2002/0033342 A1) as applied to claims 55-56, 58, 60 and 62 above, and further in view of **Basol** (US Patent No. 6,833,063 B2).

The rejection of claims 57, 59 and 61 under 35 U.S.C. 103(a) as being unpatentable over Reid et al. in combination with Uzoh et al. as applied to claims 55-56, 58, 60 and 62 above, and further in view of Basol been withdrawn in view of Applicants' amendment.

XII. Claims **63-65** have been rejected under 35 U.S.C. 103(a) as being unpatentable over **Reid et al.** (US Patent No. 6,793,796 B2) ['796] in combination with **Reid** (US Patent No. 6,024,857) ['857].

The rejection of claims 63-65 under 35 U.S.C. 103(a) as being unpatentable over Reid et al. ['796] in combination with Reid has been withdrawn in view of Applicants' amendment. Claims 63-65 have been cancelled.

XIII. Claims **66 and 67** have been rejected under 35 U.S.C. 103(a) as being unpatentable over **Reid et al.** (US Patent No. 6,793,796 B2) ['796] in combination with **Wilson et al.** (US Patent Application Publication No. 2005/0178667 A1).

The rejection of claims 66 and 67 under 35 U.S.C. 103(a) as being unpatentable

over Reid et al. ['796] in combination with Wilson et al. has been withdrawn in view of Applicants' amendment. Claim 67 has been cancelled.

XIV. Claims **68 and 69** have been rejected under 35 U.S.C. 103(a) as being unpatentable over **Reid et al.** (US Patent No. 6,793,796 B2) ['796] in combination with **Wilson et al.** (US Patent Application Publication No. 2005/0178667 A1).

The rejection of claims 68 and 69 under 35 U.S.C. 103(a) as being unpatentable over Reid et al. ['796] in combination with Wilson et al. has been withdrawn in view of Applicants' amendment. Claim 69 has been cancelled.

Composition

XV. Claims **1-5** have been rejected under 35 U.S.C. 103(a) as being unpatentable over **Grandikota et al.** (US Patent Application Publication No. 2002/0112964 A1) in combination with **Gabe et al.** (US Patent Application Publication No. 2003/0066756 A1).

The rejection of claims 1-5 under 35 U.S.C. 103(a) as being unpatentable over Grandikota et al. in combination with Gabe et al. is as applied in the Office Actions dated March 8, 2006, June 8, 2006 and April 6, 2007 and incorporated herein. The rejection has been maintained for the following reasons:

Applicants state that Gandikota was considered to make obvious the claimed lower limit of about 65 g/L. Accordingly, the claims have been amended to delete the term "about."

In response, Grandikota teaches "about 60 gm/L" of sulfuric acid (page 2, [0016]; and page 3, claims 1 and 19). The term "about 60 gm/L" disclosed by Grandikota reads on the 65 g/L sulfuric acid that is presently claimed. The word "about" permits some tolerance or flexibility to the disclosed range (MPEP § 2173.05(b)(A)).

Applicants state that the outlined rebuttal evidence discussed in reference to the Reid obviousness rejections also apply to the Gandikota rejections.

In response, a *prima facie* case of obviousness exists where claimed ranges and prior art ranges do not overlap but are close enough that one skilled in the art would have expected them to have the same properties (MPEP § 2144.05(I)).

XVI. Claims **6-14** have been rejected under 35 U.S.C. 103(a) as being unpatentable over **Grandikota et al.** (US Patent Application Publication No. 2002/0112964 A1) in combination with **Gabe et al.** (US Patent Application Publication No. 2003/0066756 A1).

With regards to claims 8-13, the rejection under 35 U.S.C. 103(a) as being unpatentable over Grandikota et al. in combination with Gabe et al. has been withdrawn in view of Applicants' amendment. Claims 8-13 have been cancelled.

With regards to claims 6-7 and 14, the rejection under 35 U.S.C. 103(a) as being unpatentable over Grandikota et al. in combination with Gabe et al. is as applied in the Office Actions dated March 8, 2006, June 8, 2006 and April 6, 2007 and incorporated herein. The rejection has been maintained for the reasons as discussed above.

Applicants' remarks have been fully considered but they are not deemed to be persuasive.

XVII. Claims **15-18** have been rejected under 35 U.S.C. 103(a) as being unpatentable over **Grandikota et al.** (US Patent Application Publication No. 2002/0112964 A1) in combination with **Gabe et al.** (US Patent Application Publication No. 2003/0066756 A1).

With regards to claim 16-18, the rejection under 35 U.S.C. 103(a) as being unpatentable over Grandikota et al. in combination with Gabe et al. has been withdrawn in view of Applicants' amendment. Claims 16-18 have been cancelled.

With regards to claim 15, the rejection under 35 U.S.C. 103(a) as being unpatentable over Grandikota et al. in combination with Gabe et al. is as applied in the Office Actions dated March 8, 2006, June 8, 2006 and April 6, 2007 and incorporated herein. The rejection has been maintained for the reasons as discussed above.

Applicants' remarks have been fully considered but they are not deemed to be persuasive.

XVIII. Claims **19-25** have been rejected under 35 U.S.C. 103(a) as being unpatentable over **Grandikota et al.** (US Patent Application Publication No. 2002/0112964 A1) in combination with **Gabe et al.** (US Patent Application Publication No. 2003/0066756 A1).

With regards to claims 23-25, the rejection under 35 U.S.C. 103(a) as being unpatentable over Grandikota et al. in combination with Gabe et al. has been withdrawn

in view of Applicants' amendment. Claims 23-25 have been cancelled.

With regards to claims 19-22, the rejection under 35 U.S.C. 103(a) as being unpatentable over Grandikota et al. in combination with Gabe et al. is as applied in the Office Actions dated March 8, 2006, June 8, 2006 and April 6, 2007 and incorporated herein. The rejection has been maintained for the reasons as discussed above.

Applicants' remarks have been fully considered but they are not deemed to be persuasive.

XIX. Claims **26-33** have been rejected under 35 U.S.C. 103(a) as being unpatentable over **Grandikota et al.** (US Patent Application Publication No. 2002/0112964 A1) in combination with **Gabe et al.** (US Patent Application Publication No. 2003/0066756 A1).

With regards to claims 27-33, the rejection under 35 U.S.C. 103(a) as being unpatentable over Grandikota et al. in combination with Gabe et al. has been withdrawn in view of Applicants' amendment.

With regards to claim 26, the rejection under 35 U.S.C. 103(a) as being unpatentable over Grandikota et al. in combination with Gabe et al. is as applied in the Office Actions dated March 8, 2006, June 8, 2006 and April 6, 2007 and incorporated herein. The rejection has been maintained for the reasons as discussed above.

Applicants' remarks have been fully considered but they are not deemed to be persuasive.

XX. Claim **34** has been rejected under 35 U.S.C. 103(a) as being unpatentable over **Grandikota et al.** (US Patent Application Publication No. 2002/0112964 A1).

The rejection of claim 34 under 35 U.S.C. 103(a) as being unpatentable over Grandikota et al. has been withdrawn in view of Applicants' amendment. Claim 34 has been cancelled.

XXI. Claims **35-43** have been rejected under 35 U.S.C. 103(a) as being unpatentable over **Grandikota et al.** (US Patent Application Publication No. 2002/0112964 A1) in combination with **Gabe et al.** (US Patent Application Publication No. 2003/0066756 A1).

The rejection of claims 35-43 under 35 U.S.C. 103(a) as being unpatentable over Grandikota et al. in combination with Gabe et al. has been withdrawn in view of Applicants' amendment. Claims 35-43 have been cancelled.

XXII. Claims **44-52** have been rejected under 35 U.S.C. 103(a) as being unpatentable over **Grandikota et al.** (US Patent Application Publication No. 2002/0112964 A1) in combination with **Gabe et al.** (US Patent Application Publication No. 2003/0066756 A1).

The rejection of claims 44-52 under 35 U.S.C. 103(a) as being unpatentable over Grandikota et al. in combination with Gabe et al. has been withdrawn in view of Applicants' amendment. Claims 44-52 have been cancelled.

XXIII. Claims **53 and 54** have been rejected under 35 U.S.C. 103(a) as being

unpatentable over **Grandikota et al.** (US Patent Application Publication No. 2002/0112964 A1) in combination with **Gabe et al.** (US Patent Application Publication No. 2003/0066756 A1).

The rejection of claims 53 and 54 under 35 U.S.C. 103(a) as being unpatentable over Grandikota et al. in combination with Gabe et al. has been withdrawn in view of Applicants' amendment. Claims 53 and 54 have been cancelled.

Method

XXIV. Claims **55-62** have been rejected under 35 U.S.C. 103(a) as being unpatentable over **Grandikota et al.** (US Patent Application Publication No. 2002/0112964 A1) in combination **Basol** (US Patent No. 6,833,063 B2) and **Uzoh et al.** (US Patent Application Publication No. 2002/0033342 A1).

The rejection of claims 55-62 rejected under 35 U.S.C. 103(a) as being unpatentable over Grandikota et al. in combination Basol (US Patent No. 6,833,063 B2) and Uzoh et al. is as applied in the Office Actions dated March 8, 2006, June 8, 2006 and April 6, 2007 and incorporated herein. The rejection has been maintained for the reasons as discussed above.

Applicants' remarks have been fully considered but they are not deemed to be persuasive.

XXV. Claims **63-65** have been rejected under 35 U.S.C. 103(a) as being unpatentable

over **Grandikota et al.** (US Patent Application Publication No. 2002/0112964 A1) in combination with **Gabe et al.** (US Patent Application Publication No. 2003/0066756 A1).

The rejection of claims 63-65 under 35 U.S.C. 103(a) as being unpatentable over Grandikota et al. in combination with Gabe et al. has been withdrawn in view of Applicants' amendment. Claims 63-65 have been cancelled.

XXVI. Claims **66 and 67** have been rejected under 35 U.S.C. 103(a) as being unpatentable over **Grandikota et al.** (US Patent Application Publication No. 2002/0112964 A1) in combination with **Reid et al.** (US Patent No. 6,793,796 B2) and **Wilson et al.** (US Patent Application Publication No. 2005/0178667 A1).

With regards to claim 67, the rejection under 35 U.S.C. 103(a) as being unpatentable over Grandikota et al. in combination with Reid et al. and Wilson et al. has been withdrawn in view of Applicants' amendment. Claim 67 has been cancelled.

With regards to claim 66, the rejection under 35 U.S.C. 103(a) as being unpatentable over Grandikota et al. in combination with Reid et al. and Wilson et al. is as applied in the Office Actions dated March 8, 2006, June 8, 2006 and April 6, 2007 and incorporated herein. The rejection has been maintained for the reasons as discussed above.

Applicants' remarks have been fully considered but they are not deemed to be persuasive.

XXVII. Claims **68 and 69** have been rejected under 35 U.S.C. 103(a) as being unpatentable over **Grandikota et al.** (US Patent Application Publication No. 2002/0112964 A1) in combination with **Reid et al.** (US Patent No. 6,793,796 B2) and **Wilson et al.** (US Patent Application Publication No. 2005/0178667 A1).

With regards to claim 69, the rejection under 35 U.S.C. 103(a) as being unpatentable over Grandikota et al. in combination with Reid et al. and Wilson et al. has been withdrawn in view of Applicants' amendment. Claim 69 has been cancelled.

With regards to claim 68, the rejection under 35 U.S.C. 103(a) as being unpatentable over Grandikota et al. in combination with Reid et al. and Wilson et al. is as applied in the Office Actions dated March 8, 2006, June 8, 2006 and April 6, 2007 and incorporated herein. The rejection has been maintained for the reasons as discussed above.

Applicants' remarks have been fully considered but they are not deemed to be persuasive.

Response to Amendment

Claim Rejections - 35 USC § 112

Claims **66 and 68** are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 66

line 8, "the principal fluid flow chamber" lacks antecedent basis.

Claim 68

line 7, "the principal fluid flow chamber" lacks antecedent basis.

line 8, "the at least two electrodes" lack antecedent basis.

Claim Rejections - 35 USC § 103

Composition

I. Claims **1-5** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Reid et al.** (US Patent No. 6,793,796 B2) ['796] in combination with **Reid** (US Patent No. 6,024,857) ['857] and **EP 1,069,210** ('210).

Reid '796 teaches an aqueous-based electroplating composition comprising:

(a) about 35 to about 50 g/L copper (= 10-60 g/l) [col. 4, lines 5-7; and col. 7, Table 1];

(b) 0 to 300 g/L sulfuric acid (col. 4, lines 5-7; and col. 7, Table 1); and

(c) a glycol-based suppressor (col. 4, lines 26-36).

The glycol-based suppressor (col. 4, lines 26-36) is present at a concentration of from about 2 to about 30 ml/L (= 1-6 ml/l) [col. 7, Table 1].

The composition further comprises a copper-deposition accelerator (col. 4, lines

10-25) present at a concentration of from about 2 to about 30 ml/L (= 0.5-8 ml/l) [page 7, Table 1].

The composition further comprises from about 10 to about 100 ppm halide ion (= 20-200 mg/l chloride ions) [col. 7, Table 1].

The composition further comprises from about 30 to about 60 ppm halide ion (= 20-200 mg/l chloride ions) [col. 7, Table 1].

The composition of Reid '796 of differs from the instant invention because Reid '796 does not disclose the following:

a. Wherein the composition comprises HCl, as recited in claim 5.

Like Reid '796, Reid '857 teaches an aqueous-based electroplating composition. The composition comprising chloride ions from HCl (cols. 5-6, Examples 1-3).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the composition described by Reid '796 with wherein the composition comprises HCl because HCl is a conventional source of chloride ions used in electroplating copper onto integrated circuit wafers having sub-micron features as taught by Reid '857 (cols. 5-6, Examples 1-3).

b. *65 to about 100 g/L* sulfuric acid, as recited in claim 1.

Reid teaches 0-300 g/l sulfuric acid (col. 4, lines 5-7; and col. 7, Table 1).

Like Reid '796, EP '210 teaches an aqueous-based electroplating composition.

Reid teaches that the copper plating electrolyte may include a sulfuric acid concentration from *about 45 g* of H_2SO_4 per L of H_2O (0.45M) *to about 110 g/L* (1.12M) to increase the conductivity of the electrolyte in the solution. The high conductivity may reduce the non-uniformity in the deposition thickness caused by the cell configuration and the differently shaped parts encountered in conventional electroplating cells (page 4, [0018]).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the sulfuric acid described by Reid '796 to 65 to about 100 g/L sulfuric acid because:

(i) a *prima facie* case of obviousness exists where claimed ranges and prior art ranges overlap or lie inside ranges disclosed by the prior art (MPEP § 2144.05(I));

(ii) it has been held that changes in temperature, concentration or both, is not a patentable modification; however, such changes may impart patentability to a process if the ranges claimed produce new and unexpected results which are different in kind and not merely in degree from results of the prior art, such ranges are termed "critical" ranges and Applicant has the burden of proving such criticality; even though Applicant's modification results in great improvement and utility over the prior art, it may still not be patentable if the modification was within capabilities of one skilled in the art; more particularly, where general conditions of the claim are disclosed in the prior art, it is not inventive to discover optimum or workable ranges by routine experimentation. *In re Aller*, 220 F2d 454, 456, 105 USPQ 233, 235 (CCPA 1955) and MPEP § 2144.05;

(iii) a sulfuric acid concentration from *about 45 g* of H_2SO_4 per L of H_2O (0.45M) *to about 110 g/L* (1.12M) would have increased the conductivity of the electrolyte in the solution. The high conductivity may reduce the non-uniformity in the deposition thickness caused by the cell configuration and the differently shaped parts encountered in conventional electroplating cells as taught by EP '210 (page 4, [0018]); and

(iv) the reason or motivation to modify the reference may often suggest what the inventor has done, but for a different purpose or to solve a different problem. It is not necessary that the prior art suggest the combination to achieve the same advantage or result discovered by the Applicants. *In re Linter* 458 F.2d 1013, 173 USPQ 560 (CCPA 1972); *In re Dillon* 919 F.2d 688, 16 USPQ2d 1897 (Fed. Cir. 1990), *cert. denied*, 500 US 904 (1991); and MPEP § 2144.

II. Claims **6-7 and 14** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Reid et al.** (US Patent No. 6,793,796 B2) ['796] in combination with **Reid** (US Patent No. 6,024,857) ['857] and **EP 1,069,210** ('210).

Reid '796 teaches an electroplating composition comprising:

(a) about 35 to about 50 g/L copper (= 10-60 g/l) [col. 4, lines 5-7; and col. 7, Table 1];

(b) 0 to 300 g/L sulfuric acid (col. 4, lines 5-7; and col. 7, Table 1); and

(c) about 2 to about 30 ml/L of a copper-deposition suppressor (= 1-6 ml/l) [col. 7, Table 1];

wherein the balance of the composition is water.

The composition further comprises a copper-deposition accelerator (col. 4, lines 10-25) present at a concentration of from about 2 to about 30 ml/L (= 0.5-8 ml/l) [page 7, Table 1].

The composition further comprises from about 10 to about 100 ppm halide ions (= 20-200 mg/l chloride ions) [col. 7, Table 1].

The composition of Reid '796 of differs from the instant invention because Reid '796 does not disclose the following:

a. Wherein the composition comprises HCl, as recited in claim 14.

Like Reid '796, Reid '857 teaches an aqueous-based electroplating composition. The composition comprising chloride ions from HCl (cols. 5-6, Examples 1-3).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the composition described by Reid '796 with wherein the composition comprises HCl because HCl is a conventional source of chloride ions used in electroplating copper onto integrated circuit wafers having sub-micron features as taught by Reid '857 (cols. 5-6, Examples 1-3).

b. *65 to about 150 g/L* sulfuric acid, as recited in claim 6.

Reid '796 teaches 0-300 g/l sulfuric acid (col. 4, lines 5-7; and col. 7, Table 1).

Like Reid '796, EP '210 teaches an aqueous-based electroplating composition.

Reid teaches that the copper plating electrolyte may include a sulfuric acid concentration from *about 45 g* of H_2SO_4 per L of H_2O (0.45M) *to about 110 g/L* (1.12M) to increase the conductivity of the electrolyte in the solution. The high conductivity may reduce the non-uniformity in the deposition thickness caused by the cell configuration and the differently shaped parts encountered in conventional electroplating cells (page 4, [0018]).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the sulfuric acid described by Reid '796 to 65 to about 150 g/L sulfuric acid because:

(i) a *prima facie* case of obviousness exists where claimed ranges and prior art ranges overlap or lie inside ranges disclosed by the prior art (MPEP § 2144.05(I));

(ii) it has been held that changes in temperature, concentration or both, is not a patentable modification; however, such changes may impart patentability to a process if the ranges claimed produce new and unexpected results which are different in kind and not merely in degree from results of the prior art, such ranges are termed "critical" ranges and Applicant has the burden of proving such criticality; even though Applicant's modification results in great improvement and utility over the prior art, it may still not be patentable if the modification was within capabilities of one skilled in the art; more particularly, where general conditions of the claim are disclosed in the prior art, it is not inventive to discover optimum or workable ranges by routine experimentation. *In re Aller*, 220 F2d 454, 456, 105 USPQ 233, 235 (CCPA 1955) and MPEP § 2144.05;

(iii) a sulfuric acid concentration from *about 45 g* of H_2SO_4 per L of H_2O (0.45M) *to about 110 g/L* (1.12M) would have increased the conductivity of the electrolyte in the solution. The high conductivity may reduce the non-uniformity in the deposition thickness caused by the cell configuration and the differently shaped parts encountered in conventional electroplating cells as taught by EP '210 (page 4, [0018]); and

(iv) the reason or motivation to modify the reference may often suggest what the inventor has done, but for a different purpose or to solve a different problem. It is not necessary that the prior art suggest the combination to achieve the same advantage or result discovered by the Applicants. *In re Linter* 458 F.2d 1013, 173 USPQ 560 (CCPA 1972); *In re Dillon* 919 F.2d 688, 16 USPQ2d 1897 (Fed. Cir. 1990), *cert. denied*, 500 US 904 (1991); and MPEP § 2144.

III. Claim **15** is rejected under 35 U.S.C. 103(a) as being unpatentable over **Reid et al.** (US Patent No. 6,793,796 B2) ['796] in combination with **Reid** (US Patent No. 6,024,857) ['857] and **EP 1,069,210** ('210).

Reid '796 teaches an aqueous electroplating composition comprising:

(a) about 35 to about 50 g/L copper (= 10-60 g/l) [col. 4, lines 5-7; and col. 7, Table 1];

(b) 0 to 300 g/L sulfuric acid (col. 4, lines 5-7; and col. 7, Table 1);

(c) about 2 to about 30 ml/L copper-deposition accelerator (= 0.5-8 ml/l) [page 7, Table 1];

(d) about 2 to about 30 ml/L of a copper-deposition suppressor (= 1-6 ml/l) [col. 7, Table 1]; and

(e) about 40 to about 60 ppm chloride ions (= 20-200 mg/l) [col. 7, Table 1].

The composition of Reid '796 of differs from the instant invention because Reid '796 does not disclose the following:

a. Wherein the aqueous electroplating composition comprises hydrogen chloride, as recited in claim 15.

Like Reid '796, Reid '857 teaches an aqueous-based electroplating composition. The composition comprising chloride ions from HCl (cols. 5-6, Examples 1-3).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the composition described by Reid '796 with wherein the aqueous electroplating composition comprises hydrogen chloride because HCl is a conventional source of chloride ions used in electroplating copper onto integrated circuit wafers having sub-micron features as taught by Reid '857 (cols. 5-6, Examples 1-3).

b. *65 to about 100 g/L* sulfuric acid, as recited in claim 15.

Reid '796 teaches 0-300 g/l sulfuric acid (col. 4, lines 5-7; and col. 7, Table 1).

Like Reid '796, EP '210 teaches an aqueous-based electroplating composition.

Reid teaches that the copper plating electrolyte may include a sulfuric acid concentration from *about 45 g* of H_2SO_4 per L of H_2O (0.45M) *to about 110 g/L* (1.12M) to increase the conductivity of the electrolyte in the solution. The high conductivity may reduce the non-uniformity in the deposition thickness caused by the cell configuration and the differently shaped parts encountered in conventional electroplating cells (page 4, [0018]).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the sulfuric acid described by Reid '796 to 65 to about 100 g/L sulfuric acid because:

(i) a *prima facie* case of obviousness exists where claimed ranges and prior art ranges overlap or lie inside ranges disclosed by the prior art (MPEP § 2144.05(I));

(ii) it has been held that changes in temperature, concentration or both, is not a patentable modification; however, such changes may impart patentability to a process if the ranges claimed produce new and unexpected results which are different in kind and not merely in degree from results of the prior art, such ranges are termed "critical" ranges and Applicant has the burden of proving such criticality; even though Applicant's modification results in great improvement and utility over the prior art, it may still not be patentable if the modification was within capabilities of one skilled in the art; more particularly, where general conditions of the claim are disclosed in the prior art, it is not inventive to discover optimum or workable ranges by routine experimentation. *In re Aller*, 220 F2d 454, 456, 105 USPQ 233, 235 (CCPA 1955) and MPEP § 2144.05;

(iii) a sulfuric acid concentration from *about 45 g* of H_2SO_4 per L of H_2O (0.45M) *to about 110 g/L* (1.12M) would have increased the conductivity of the electrolyte in the solution. The high conductivity may reduce the non-uniformity in the deposition thickness caused by the cell configuration and the differently shaped parts encountered in conventional electroplating cells as taught by EP '210 (page 4, [0018]); and

(iv) the reason or motivation to modify the reference may often suggest what the inventor has done, but for a different purpose or to solve a different problem. It is not necessary that the prior art suggest the combination to achieve the same advantage or result discovered by the Applicants. *In re Linter* 458 F.2d 1013, 173 USPQ 560 (CCPA 1972); *In re Dillon* 919 F.2d 688, 16 USPQ2d 1897 (Fed. Cir. 1990), *cert. denied*, 500 US 904 (1991); and MPEP § 2144.

IV. Claims **19-22** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Reid et al.** (US Patent No. 6,793,796 B2) ['796] in combination with **EP 1,069,210** ('210).

Reid '796 teaches an electroplating composition comprising:

(a) about 45 to about 50 g/L copper (= 10-60 g/l) [col. 4, lines 5-7; and col. 7, Table 1];

(b) 0 to 300 g/L sulfuric acid (col. 4, lines 5-7; and col. 7, Table 1);

(c) a copper-deposition suppressor (col. 4, lines 26-36); and

(d) a copper-deposition accelerator (col. 4, lines 10-26).

The copper-deposition suppressor is at a concentration of from about 2 to about 10 ml/L (= 1-6 ml/l) [col. 7, Table 1].

The copper-deposition accelerator is at a concentration of from about 2 to about 8 ml/L (= 0.5-8 ml/l) [page 7, Table 1];

The composition further comprises from about 10 to about 1000 ppm halide ion (= 20-200 mg/l) [col. 7, Table 1].

The composition of Reid '796 of differs from the instant invention because Reid '796 does not disclose *75 to about 100 g/L* sulfuric acid, as recited in claim 19.

Reid '796 teaches 0-300 g/l sulfuric acid (col. 4, lines 5-7; and col. 7, Table 1).

Like Reid '796, EP '210 teaches an aqueous-based electroplating composition. Reid teaches that the copper plating electrolyte may include a sulfuric acid concentration from *about 45 g* of H_2SO_4 per L of H_2O (0.45M) *to about 110 g/L* (1.12M) to increase the conductivity of the electrolyte in the solution. The high conductivity may reduce the non-uniformity in the deposition thickness caused by the cell configuration and the differently shaped parts encountered in conventional electroplating cells (page 4, [0018]).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the sulfuric acid described by Reid '796 to 75 to about 100 g/L sulfuric acid because:

(i) a *prima facie* case of obviousness exists where claimed ranges and prior art

ranges overlap or lie inside ranges disclosed by the prior art (MPEP § 2144.05(I));

(ii) it has been held that changes in temperature, concentration or both, is not a patentable modification; however, such changes may impart patentability to a process if the ranges claimed produce new and unexpected results which are different in kind and not merely in degree from results of the prior art, such ranges are termed "critical" ranges and Applicant has the burden of proving such criticality; even though Applicant's modification results in great improvement and utility over the prior art, it may still not be patentable if the modification was within capabilities of one skilled in the art; more particularly, where general conditions of the claim are disclosed in the prior art, it is not inventive to discover optimum or workable ranges by routine experimentation. *In re Aller*, 220 F2d 454, 456, 105 USPQ 233, 235 (CCPA 1955) and MPEP § 2144.05;

(iii) a sulfuric acid concentration from *about 45 g* of H_2SO_4 per L of H_2O (0.45M) *to about 110 g/L* (1.12M) would have increased the conductivity of the electrolyte in the solution. The high conductivity may reduce the non-uniformity in the deposition thickness caused by the cell configuration and the differently shaped parts encountered in conventional electroplating cells as taught by EP '210 (page 4, [0018]); and

(iv) the reason or motivation to modify the reference may often suggest what the inventor has done, but for a different purpose or to solve a different problem. It is not necessary that the prior art suggest the combination to achieve the same advantage or result discovered by the Applicants. *In re Linter* 458 F.2d 1013, 173 USPQ 560 (CCPA 1972); *In re Dillon* 919 F.2d 688, 16 USPQ2d 1897 (Fed. Cir. 1990), *cert. denied*, 500

US 904 (1991); and MPEP § 2144.

V. Claim **26** is rejected under 35 U.S.C. 103(a) as being unpatentable over **Reid et al.** (US Patent No. 6,793,796 B2) ['796] in combination with **EP 1,069,210** ('210).

Reid '796 teaches an electroplating composition comprising:

(a) an aqueous mixture of copper and sulfuric acid (col. 7, Table 1).

(b) a copper-deposition accelerator (col. 4, lines 10-25); and

(c) a copper-deposition suppressor (col. 4, lines 26-36).

The composition of Reid '796 of differs from the instant invention because Reid '796 does not disclose wherein the ratio in g/L of solution of copper to acid is equal to *about 0.4 to about 0.7*, as recited in claim 26.

Reid '796 teaches 10-60 g/l of copper ions and 0-300 g/l sulfuric acid (col. 4, lines 5-7; and col. 7, Table 1).

Like Reid '796, EP '210 teaches an aqueous-based electroplating composition. Reid teaches that the copper plating electrolyte may include a sulfuric acid concentration from *about 45 g* of H_2SO_4 per L of H_2O (0.45M) *to about 110 g/L* (1.12M) to increase the conductivity of the electrolyte in the solution. The high conductivity may reduce the non-uniformity in the deposition thickness caused by the cell configuration and the differently shaped parts encountered in conventional electroplating cells (page

4, [0018]).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the sulfuric acid described by Reid '796 to wherein the ratio in g/L of solution of copper to acid is equal to about 0.4 to about 0.7 because:

(i) a *prima facie* case of obviousness exists where claimed ranges and prior art ranges overlap or lie inside ranges disclosed by the prior art (MPEP § 2144.05(I));

(ii) it has been held that changes in temperature, concentration or both, is not a patentable modification; however, such changes may impart patentability to a process if the ranges claimed produce new and unexpected results which are different in kind and not merely in degree from results of the prior art, such ranges are termed "critical" ranges and Applicant has the burden of proving such criticality; even though Applicant's modification results in great improvement and utility over the prior art, it may still not be patentable if the modification was within capabilities of one skilled in the art; more particularly, where general conditions of the claim are disclosed in the prior art, it is not inventive to discover optimum or workable ranges by routine experimentation. *In re Aller*, 220 F2d 454, 456, 105 USPQ 233, 235 (CCPA 1955) and MPEP § 2144.05;

(iii) a sulfuric acid concentration from *about 45 g* of H_2SO_4 per L of H_2O (0.45M) *to about 110 g/L* (1.12M) would have increased the conductivity of the electrolyte in the solution. The high conductivity may reduce the non-uniformity in the deposition thickness caused by the cell configuration and the differently shaped parts encountered

in conventional electroplating cells as taught by EP '210 (page 4, [0018]); and

(iv) the reason or motivation to modify the reference may often suggest what the inventor has done, but for a different purpose or to solve a different problem. It is not necessary that the prior art suggest the combination to achieve the same advantage or result discovered by the Applicants. *In re Linter* 458 F.2d 1013, 173 USPQ 560 (CCPA 1972); *In re Dillon* 919 F.2d 688, 16 USPQ2d 1897 (Fed. Cir. 1990), *cert. denied*, 500 US 904 (1991); and MPEP § 2144.

Method

VI. Claims **55-56, 58, 60 and 62** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Reid et al.** (US Patent No. 6,793,796 B2) ['796] in combination with **Uzoh et al.** (US Patent No. 6,355,153) and **EP 1,069,210** ('210).

Reid '796 teaches a method for plating a workpiece comprising:

(a) providing a workpiece **10** having a plurality of device features **14, 16** including a seed layer **18** wherein the plurality of device features is to be metallized (col. 3, lines 31-43; and Fig 1); and

(b) electrolytically depositing copper within the plurality of device features (col. 6, "Bottom-up Filling Phase") utilizing an electroplating composition comprising about 35 to about 50 g/L copper (= 10-60 g/l), 0 to 300 g/L sulfuric acid (col. 4, lines 5-7), and a glycol-based suppressor (col. 4, lines 26-36) [col. 7, Table 1].

The method further comprises a seed enhancement procedure (col. 5, "Initiation

Phase").

The method further comprises selective etching of copper deposited on the workpiece (= CMP) [col. 8, line 1; and lines 49-50].

The electroplating composition comprises from about 35 to about 50 g/L copper (= 10-60 g/l), 0 to 300 g/L sulfuric acid (col. 4, lines 5-7), and from about 2 to about 30 ml/L (1-6 ml/l) of a glycol-based suppressor (col. 4, lines 26-36) [col. 7, Table 1].

The method of Reid '796 of differs from the instant invention because Reid '796 does not disclose the following:

a. Annealing the workpiece at temperatures below about 100°C, as recited in claim 60.

Like Reid '796, Uzoh teaches a method for plating a workpiece. Uzoh teaches that for optimum interconnect performance, it is highly desirable to stabilize the structure by annealing the deposited copper. The annealing temperature may range from 60° to 450° C in an inert ambient such as nitrogen or in a reducing ambient, or even in a vacuum chamber (col. 11, lines 40-48).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method described by Reid '796 by annealing the workpiece at temperatures below about 100°C because the structure would have been stabilized by annealing the deposited copper as taught by Uzoh (page 6, [0073]).

b. *65 to about 100 g/L* sulfuric acid, as recited in claims 55 and 62.

Reid '796 teaches 0-300 g/l sulfuric acid (col. 4, lines 5-7; and col. 7, Table 1).

Like Reid '796, EP '210 teaches an aqueous-based electroplating composition. Reid teaches that the copper plating electrolyte may include a sulfuric acid concentration from *about 45 g* of H_2SO_4 per L of H_2O (0.45M) *to about 110 g/L* (1.12M) to increase the conductivity of the electrolyte in the solution. The high conductivity may reduce the non-uniformity in the deposition thickness caused by the cell configuration and the differently shaped parts encountered in conventional electroplating cells (page 4, [0018]).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the sulfuric acid described by Reid '796 to 75 to about 100 g/L sulfuric acid because:

(i) a *prima facie* case of obviousness exists where claimed ranges and prior art ranges overlap or lie inside ranges disclosed by the prior art (MPEP § 2144.05(I));

(ii) it has been held that changes in temperature, concentration or both, is not a patentable modification; however, such changes may impart patentability to a process if the ranges claimed produce new and unexpected results which are different in kind and not merely in degree from results of the prior art, such ranges are termed "critical" ranges and Applicant has the burden of proving such criticality; even though Applicant's modification results in great improvement and utility over the prior art, it may still not be patentable if the modification was within capabilities of one skilled in the art; more

particularly, where general conditions of the claim are disclosed in the prior art, it is not inventive to discover optimum or workable ranges by routine experimentation. *In re Aller*, 220 F2d 454, 456, 105 USPQ 233, 235 (CCPA 1955) and MPEP § 2144.05;

(iii) a sulfuric acid concentration from *about 45 g* of H_2SO_4 per L of H_2O (0.45M) *to about 110 g/L* (1.12M) would have increased the conductivity of the electrolyte in the solution. The high conductivity may reduce the non-uniformity in the deposition thickness caused by the cell configuration and the differently shaped parts encountered in conventional electroplating cells as taught by EP '210 (page 4, [0018]); and

(iv) the reason or motivation to modify the reference may often suggest what the inventor has done, but for a different purpose or to solve a different problem. It is not necessary that the prior art suggest the combination to achieve the same advantage or result discovered by the Applicants. *In re Linter* 458 F.2d 1013, 173 USPQ 560 (CCPA 1972); *In re Dillon* 919 F.2d 688, 16 USPQ2d 1897 (Fed. Cir. 1990), *cert. denied*, 500 US 904 (1991); and MPEP § 2144.

VII. Claims **57, 59 and 61** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Reid et al.** (US Patent No. 6,793,796 B2) ['796] in combination with **Uzoh et al.** (US Patent No. 6,355,153) and **EP 1,069,210** ('210) as applied to claims 55-56, 58, 60 and 62 above, and further in view of **Basol** (US Patent No. 6,833,063 B2).

Reid '796, Uzoh and EP '210 are as applied above and incorporated herein.

The method of Reid '796 differs from the instant invention because they do not

disclose the following:

a. Rinsing and drying the workpiece during processing, wherein the rinsing and/or the drying occurs in a chamber in which the deposition of copper is performed, as recited in claim 57.

b. Cleaning the backside of the workpiece after copper is deposited on the workpiece, as recited in claim 59.

c. Precleaning the workpiece prior to depositing copper wherein the precleaning of the workpiece is performed in the same plating tool in which the deposition is performed, as recited in claim 61.

Like Reid '796, Basol teaches a method for plating a workpiece. Basol teaches a system that allows for edge conductor removal, workpiece front surface cleaning, or both to be performed in the same processing chamber that is used for deposition or removal processing of the workpiece (col. 3, lines 61-65; and col. 14, claim 7). This allows for more efficient processing, including the removal of edge copper from a front face of the wafer, and removal of edge copper as part of other cleaning processes (col. 3, lines 34-38).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method described by Reid '796 by rinsing and drying the workpiece during processing, wherein the rinsing and/or the drying occurs in a chamber in which the deposition of copper is performed; cleaning the backside of the workpiece after copper is deposited on the workpiece; and precleaning the workpiece

prior to depositing copper wherein the precleaning of the workpiece is performed in the same plating tool in which the deposition is performed because this would have allowed for more efficient processing, including the removal of edge copper from a front face of the wafer, and removal of edge copper as part of other cleaning processes as taught by Basol (col. 3, lines 34-38).

VIII. Claim **66** is rejected under 35 U.S.C. 103(a) as being unpatentable over **Reid et al.** (US Patent No. 6,793,796 B2) ['796] in combination with **Wilson et al.** (US Patent Application Publication No. 2005/0178667 A1) and **EP 1,069,210** ('210).

Reid '796 teaches a process for applying a metallization interconnect structure, comprising:

(a) providing a workpiece **10** on which a metal seed layer **18** has been formed using a first deposition process (col. 5, "Entry Phase");

(b) enhancing the seed layer by electrochemically depositing additional metal on the seed layer within a principal fluid chamber of a reactor to provide an enhanced seed layer using a deposition process comprising supplying electroplating power to an anode within the principal fluid flow chamber relative to the workpiece (cols. 5-6, "Initiation Phase"); and

(c) electrolytically depositing a metal on the enhanced seed layer (col. 6, "Bottom-up Filling Phase") utilizing an electroplating composition comprising about 35 to about 50 g/L copper (= 10-60 g/l), 0 to 300 g/L sulfuric acid (col. 4, lines 5-9) and a

glycol-based suppressor (col. 4, lines 26-36) [col. 7, Table 1].

The method of Reid '796 of differs from the instant invention because Reid '796 does not disclose the following:

a. Wherein the anode is a plurality of concentric anodes disposed at different positions within the principal fluid flow chamber relative to the workpiece, as recited in claim 66.

Like Reid '796, Wilson teaches a process for applying a metallization interconnect structure. Wilson teaches that the current is applied by a plurality of electrodes in a manner that can account for different plating characteristics at different portions of the workpiece, and the current applied to individual electrodes is changed to account for changes in behavior as thickness of the conductive material on the workpiece increases. As a result, conductive material such as copper are deposited on the workpiece at a uniform current density or other desired current density to provide a conductive layer having the desired properties (page 2, [0010] and [0011]).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the anode described by Reid '796 with wherein the anode is a plurality of concentric anodes disposed at different positions within the principal fluid flow chamber relative to the workpiece because this would have resulted in depositing a conductive material such as copper on the workpiece at a uniform current density or other desired current density to provide a conductive layer having the

desired properties as taught by Wilson (page 2, [0010] and [0011]).

b. *65 to about 100 g/L* sulfuric acid, as recited in claim 66.

Reid '796 teaches 0-300 g/l sulfuric acid (col. 4, lines 5-7; and col. 7, Table 1).

Like Reid '796, EP '210 teaches an aqueous-based electroplating composition. Reid teaches that the copper plating electrolyte may include a sulfuric acid concentration from *about 45 g* of H_2SO_4 per L of H_2O (0.45M) *to about 110 g/L* (1.12M) to increase the conductivity of the electrolyte in the solution. The high conductivity may reduce the non-uniformity in the deposition thickness caused by the cell configuration and the differently shaped parts encountered in conventional electroplating cells (page 4, [0018]).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the sulfuric acid described by Reid '796 to 65 to about 100 g/L sulfuric acid because:

(i) a *prima facie* case of obviousness exists where claimed ranges and prior art ranges overlap or lie inside ranges disclosed by the prior art (MPEP § 2144.05(I));

(ii) it has been held that changes in temperature, concentration or both, is not a patentable modification; however, such changes may impart patentability to a process if the ranges claimed produce new and unexpected results which are different in kind and not merely in degree from results of the prior art, such ranges are termed "critical" ranges and Applicant has the burden of proving such criticality; even though Applicant's

modification results in great improvement and utility over the prior art, it may still not be patentable if the modification was within capabilities of one skilled in the art; more particularly, where general conditions of the claim are disclosed in the prior art, it is not inventive to discover optimum or workable ranges by routine experimentation. *In re Aller*, 220 F2d 454, 456, 105 USPQ 233, 235 (CCPA 1955) and MPEP § 2144.05;

(iii) a sulfuric acid concentration from *about 45 g* of H_2SO_4 per L of H_2O (0.45M) *to about 110 g/L* (1.12M) would have increased the conductivity of the electrolyte in the solution. The high conductivity may reduce the non-uniformity in the deposition thickness caused by the cell configuration and the differently shaped parts encountered in conventional electroplating cells as taught by EP '210 (page 4, [0018]); and

(iv) the reason or motivation to modify the reference may often suggest what the inventor has done, but for a different purpose or to solve a different problem. It is not necessary that the prior art suggest the combination to achieve the same advantage or result discovered by the Applicants. *In re Linter* 458 F.2d 1013, 173 USPQ 560 (CCPA 1972); *In re Dillon* 919 F.2d 688, 16 USPQ2d 1897 (Fed. Cir. 1990), *cert. denied*, 500 US 904 (1991); and MPEP § 2144.

IX. Claim **68** is rejected under 35 U.S.C. 103(a) as being unpatentable over **Reid et al.** (US Patent No. 6,793,796 B2) ['796] in combination with **Wilson et al.** (US Patent Application Publication No. 2005/0178667 A1) and **EP 1,069,210** ('210).

Reid '796 teaches a process for applying a metallization interconnect structure,

comprising:

(a) providing a workpiece **10** on which a metal seed layer **18** has been formed;

(b) enhancing the seed layer by electrochemically depositing additional metal on the seed layer within a principal fluid chamber of a reactor to provide an enhanced seed layer using a deposition process comprising supplying electroplating power to an anode within the principal fluid flow chamber (cols. 5-6, "Initiation Phase");

(c) electrolytically depositing copper on the enhanced seed layer (col. 6, "Bottom-up Filling Phase") under conditions in which the deposition rate of the electrolytic deposition process is substantially greater than the deposition rate of the process used to enhance the metal seed (col. 8, lines 40-47) utilizing an electroplating composition comprising a mixture of copper and sulfuric acid (col. 4, lines 5-7, a copper-deposition suppressor (col. 4, lines 26-36), and a copper-deposition accelerator (col. 4, lines 10-25) [col. 7, Table 1].

The method of Reid '796 of differs from the instant invention because Reid '796 does not disclose the following:

a. Wherein the anode is a plurality of electrodes within the principal fluid flow chamber, as recited in claim 68.

b. Independently controlling the supply of electrical power to the at least two electrodes during enhancing of the seed layer, as recited in claim 68.

Like Reid '796, Wilson teaches a process for applying a metallization

interconnect structure. Wilson teaches that the current is applied by a plurality of electrodes in a manner that can account for different plating characteristics at different portions of the workpiece, and the current applied to individual electrodes is changed to account for changes in behavior as thickness of the conductive material on the workpiece increases. As a result, conductive material such as copper are deposited on the workpiece at a uniform current density or other desired current density to provide a conductive layer having the desired properties (page 2, [0010] and [0011]).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the anode described by Reid '796 with wherein the anode is a plurality of electrodes within the principal fluid flow chamber; and to have modified the method described by Reid '796 by independently controlling the supply of electrical power to the at least two electrodes during enhancing of the seed layer because this would have resulted in depositing a conductive material such as copper on the workpiece at a uniform current density or other desired current density to provide a conductive layer having the desired properties as taught by Wilson (page 2, [0010] and [0011]).

Wilson also teaches independently controlling the supply of electrical power to the at least two electrodes during repair of the seed layer (page 11, [0092]).

c. Wherein the ratio in g/L of solution of copper to acid is equal to *about 0.4 to about 0.7*, as recited in claim 68.

Reid '796 teaches 10-60 g/l of copper ions and 0-300 g/l sulfuric acid (col. 4, lines 5-7; and col. 7, Table 1).

Like Reid '796, EP '210 teaches an aqueous-based electroplating composition. Reid teaches that the copper plating electrolyte may include a sulfuric acid concentration from *about 45 g* of H_2SO_4 per L of H_2O (0.45M) *to about 110 g/L* (1.12M) to increase the conductivity of the electrolyte in the solution. The high conductivity may reduce the non-uniformity in the deposition thickness caused by the cell configuration and the differently shaped parts encountered in conventional electroplating cells (page 4, [0018]).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the sulfuric acid described by Reid '796 to wherein the ratio in g/L of solution of copper to acid is equal to about 0.4 to about 0.7 because:

(i) a *prima facie* case of obviousness exists where claimed ranges and prior art ranges overlap or lie inside ranges disclosed by the prior art (MPEP § 2144.05(I));

(ii) it has been held that changes in temperature, concentration or both, is not a patentable modification; however, such changes may impart patentability to a process if the ranges claimed produce new and unexpected results which are different in kind and not merely in degree from results of the prior art, such ranges are termed "critical" ranges and Applicant has the burden of proving such criticality; even though Applicant's modification results in great improvement and utility over the prior art, it may still not be

patentable if the modification was within capabilities of one skilled in the art; more particularly, where general conditions of the claim are disclosed in the prior art, it is not inventive to discover optimum or workable ranges by routine experimentation. *In re Aller*, 220 F2d 454, 456, 105 USPQ 233, 235 (CCPA 1955) and MPEP § 2144.05;

(iii) a sulfuric acid concentration from *about 45 g* of H_2SO_4 per L of H_2O (0.45M) *to about 110 g/L* (1.12M) would have increased the conductivity of the electrolyte in the solution. The high conductivity may reduce the non-uniformity in the deposition thickness caused by the cell configuration and the differently shaped parts encountered in conventional electroplating cells as taught by EP '210 (page 4, [0018]); and

(iv) the reason or motivation to modify the reference may often suggest what the inventor has done, but for a different purpose or to solve a different problem. It is not necessary that the prior art suggest the combination to achieve the same advantage or result discovered by the Applicants. *In re Linter* 458 F.2d 1013, 173 USPQ 560 (CCPA 1972); *In re Dillon* 919 F.2d 688, 16 USPQ2d 1897 (Fed. Cir. 1990), *cert. denied*, 500 US 904 (1991); and MPEP § 2144.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to EDNA WONG whose telephone number is (571) 272-1349. The examiner can normally be reached on Mon-Fri 7:30 am to 4:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on (571) 272-1342. The fax phone number

for the organization where this application or proceeding is assigned is 571-273-8300.

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/Edna Wong/
Primary Examiner
Art Unit 1795

EW
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